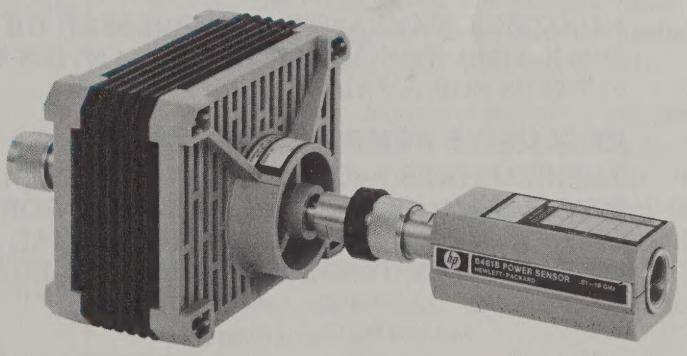
OPERATING AND SERVICE MANUAL

8481B
8482B
POWER SENSOR



HEWLETT PACKARD

Printed: March 1981

HP 8481B
HP 8482B

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

GENERAL INFORMATION

This Operating and Service Manual contains information about initial inspection, performance tests, adjustments, operation, troubleshooting and repair of the Models 8481B and 8482B Power Sensors.

On the rear cover of this manual is a "Microfiche" part number. This number can be used to order a 10x15 cm (4x6 in.) microfilm transparency of the manual.

Specifications

Power Sensor specifications are listed in Table 1. These specifications are the performance standards, or limits against which the power sensors may be tested. Supplemental characteristics in Table 2 are not specifications but are typical characteristics included as additional information for the user.

Table 1. Specifications

Frequency Range: 8481B, 10 MHz to 18.0 GHz
8482B, 100 kHz to 4.2 GHz

Power Measurement Range:
1 mW to 25W (0 to +44 dBm) at 0 to ≤+35°C
1 mW to 20W (0 to +43 dBm at >+35°C to +55°C

Power Linearity[1]:
± 4%, CW 3 to 25W

Maximum Input Power:
Average[2] 30W at 0 to ≤+35°C
25W at >+35°C up to +55°C

Peak 500W for the 8481B 10 MHz to ≤5.8 GHz
125W for the 8481B >5.8 GHz up to 18.0 GHz
500W for the 8482B 100 kHz to 4.2 GHz

Energy per pulse 500W·μs

Input Impedance: 50 ohms, nominal

Maximum SWR (Reflection Coefficient):
8481B: 1.10 (0.048) 10 MHz to ≤2.0 GHz
1.18 (0.083) >2.0 GHz up to ≤12.4 GHz
1.28 (0.123) >12.4 GHz up to 18.0 GHz
8482B: 1.10 (0.048) 100 kHz to ≤2.0 GHz
1.18 (0.083) >2.0 GHz up to 4.2 GHz

Connectors:
Input is type N male[3]
Output mates with power meter connector cable.

[1] Negligible deviation below 3W CW.

[2] For pulses greater than 30W the maximum average power (Pa) is limited by the energy per pulse (E) in W·μs according to Pa = 30 — 0.02E.

[3] Compatible with U.S. MIL-C-71B and U.S. MIL-C-39012B.

Table 2. Supplemental Characteristics*

Dimensions:
83 x 114 x 248 mm (approx. 3.25 x 4.50 x 9.75 in.)

Weight: 0.8 kg (1.7 lbs.)

*Supplemental characteristics are given for information purposes only.

Safety Considerations

The warning that follows is related to possible personal injury.

WARNING

The high power attenuator card has a substrate of beryllium oxide. Beryllium oxide in a powder form is a hazardous material and may be injurious to your health if inhaled. Do not perform any operation on the beryllium oxide that might generate dust. Defective attenuator cards should be returned to Hewlett-Packard for proper disposal.

Power Sensors Covered by Manual

Each power sensor has a two-part serial number. The first four digits and the letter comprise the serial number prefix. The last five digits for a sequential suffix which is unique to each power sensor. The contents of this manual apply directly to sensors having the serial number prefix 1801A for the 8481B and 1802A for the 8482B.

A power sensor manufactured after the printing of this manual may have a serial prefix that is not noted above. This unlisted serial prefix indicates that the sensor differs in some respect from the information in this manual. The manual for that sensor is supplied with a yellow Manual Changes supplement containing "change information" that documents the differences.

In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement is keyed to the manual print date and part number.

Complimentary copies of the supplement are available on request from your nearest Hewlett-Packard office.

For information concerning a serial number prefix not listed in this Manual or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

Description

The 25 watt power sensor is a calibrated combination of a 30 dB, 25 watt attenuator assembly and a low-power sensor assembly. The attenuator and sensor assemblies are calibrated as a set and must be used together if specified accuracies are to be attained. The combination will be referred to as the power sensor.

The power sensor is used for measuring the power supplied by an RF source to a 50-ohm load. In use, the power sensor is connected to the RF source and to an HP 435A or HP 436A Power Meter.

The power sensor presents a 50-ohm impedance to the RF source, and the power meter indicates the power dissipated in this load. The power is determined from the RF voltage developed across the sensor assembly load, and is expressed in mW (or W) and dBm. The HP 436A Power Meter can also provide readings, in dB, relative to a previous RF input to the power sensor.

The power sensor measures power levels from 0 dBm to +44 dBm (1 mW to 25W), at frequencies from 10 MHz to 18 GHz (8481B) or 100 kHz to 4.2 GHz (8482B).

The physical configuration of both power sensors is the same. However, because of the different frequency ranges covered, there are some changes in the part numbers and component values.

Calibration data is provided by a graph on the power sensor. The graph, individually prepared for each power sensor, shows the calibration factor (CAL FACTOR) at several frequencies. This calibration factor is used to adjust the power meter to suit the particular power sensor and RF frequency. Calibration data is valid only when the sensor assembly is used with the attenuator assembly that is supplied with it. Table 3 shows the uncertainty of the calibration factor.

Warranty

The power sensor is warranted and certified as indicated on the warranty page of this manual. For further information, contact the nearest Hewlett-Packard Sales and Service office. The addresses of the major offices are provided at the rear of this manual.

The power sensor is warranted only when it is operated within its specifications, especially power handling capability. Any power sensor returned to Hewlett-Packard under warranty will be examined carefully to determine if the failure was possibly due to improper use.

Table 3. Uncertainty of Calibration Factor

Power Sensor	Frequency	Sum of Uncertainties (%)	Probable Uncertainties (%)*
	0.01 GHz	5.4	2.7
	0.05	2.7	2.7
	0.1	6.4	3.0
	2.0	5.8	3.1
	3.0	5.8	3.1
	4.0	5.8	3.1
8	5.0	5.8	3.1
4	6.0	5.8	3.1
8	7.0	5.8	3.1
1	8.0	6.0	3.2
B	9.0	6.0	3.2
	10.0	6.2	3.3
	11.0	6.2	3.3
	12.4	7.8	4.1
	13.0	7.8	4.1
	14.0	7.9	4.1
	15.0	7.9	4.1
	16.0	8.0	4.2
	17.0	8.0	4.2
	18.0	8.3	4.3
	0.1 MHz	5.7	2.8
	0.3	5.7	2.8
8	1.0	5.7	2.8
4	3.0	5.7	2.8
8	10.0	5.7	2.8
2	30.0	5.7	2.8
B	50.0	2.7	2.7
	100	5.6	3.3
	300	5.6	3.3
	1000	5.7	3.3
	2000	5.5	3.1
	3000	5.5	3.1
	4200	5.5	3.1

*Square root of the sum of the squares.

CAUTION

Removal of the D-ring that is on the sensor assembly WILL VOID THE WARRANTY. The input connector on the sensor has a D-ring to prevent the sensor from being connected to a high power source when its attenuator is not attached. The sensor must only be connected to the power meter for calibration or to the high power attenuator for RF measurement.

Accessory Supplied

A range switch scale is supplied with each power sensor. The range switch scale (disc) is to be used with the HP 435-series power meters. The disc is not required for the HP 436A because of the autoranging digital readout. The disc part number is HP 0350-0153.

Recommended Test Equipment

Table 4 lists the test equipment recommended to check, adjust, and troubleshoot the power sensor. If substitute equipment is used, it must meet or exceed the critical specifications.

INSTALLATION

Initial Inspection

Inspect the shipping container. If the container or packing material is damaged it should be kept until the contents of the shipment have been checked mechanically and electrically. If there is mechanical damage or if the instrument does not pass the performance tests, notify the nearest Hewlett-Packard office. Keep the damaged shipping materials (if any) for inspection by the carrier and a Hewlett-Packard representative.

Handling Precaution

CAUTION

Do not drop or otherwise mechanically damage the power sensor.

Mating Connectors

Refer to the power meter operating and service manual for interconnecting instructions to the power meter. The RF input connector is a Type-N male.

Table 4. Recommended Test Equipment

Instrument Type	Critical Specifications	Suggested Model	Use*
Digital Voltmeter/ Ohmmeter	Voltage Range: 100 mVdc to 100 Vdc Input Impedance: 10 megohms Resolution: 4-digit Accuracy: ±0.05% ±1 digit Resistance Range: 1 ohm to 100,000 ohms Accuracy: ±5%	HP 3455A	T
Oscilloscope	Bandwidth: dc to 50 MHz Sensitivity: Vertical, 0.2 V/div Horizontal, 1 ms/div	HP 1740A	A, T
10:1 Divider Probe	10 megohms 10 pF	HP 10004D	A
DC Power Supply	Range: 0—20 Vdc Load Regulation: 0.01% +4 mV	HP 6200B	T

*A = Adjustment, T = Troubleshooting

CAUTION

The input connector on the sensor has a D-ring to prevent the sensor from being connected to a high power source when its attenuator is not attached. The sensor must only be connected to the power meter for calibration or to the high power attenuator for RF measurement.

Storage and Shipment Environment

The sensor should be stored in a clean, dry environment. The following limitations apply to both storage and shipment:

Temperature ..... −40 to +75° C
Humidity ..... ⩽95% relative at 40° C
Altitude ..... <15 300 metres (50 000 feet).

Original Packaging

Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the sensor is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and serial number. Also, mark the container FRAGILE to assure careful handling. In any correspondence, refer to the sensor by model number and serial number.

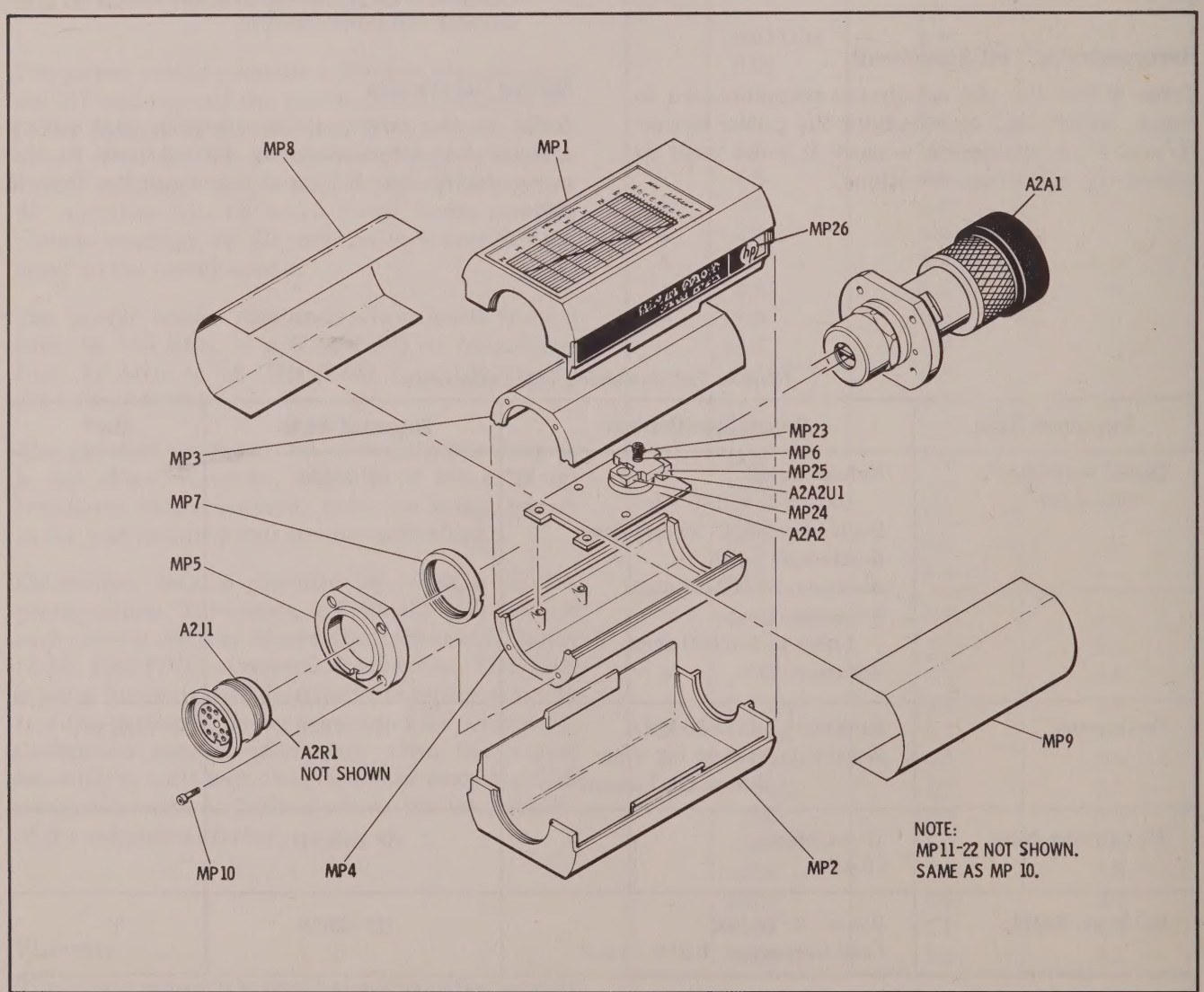


Figure 1. Illustrated Parts Breakdown of the A2 Sensor Assembly

OPERATION

Operating Procedures

Instructions for use of the power sensor are provided in the power meter manual. Note, however, the different calibration procedure described in the paragraph below. During operation, the operating precautions must be observed.

Environment

The operating environment for the power sensor should be as follows:

Temperature ..... 0 to 55°C
Humidity ..... ≤95% relative at 40°C
Altitude ..... <4600 metres (15 000 feet)

Operating Precautions

Before the power sensor is connected, the following precautions must be observed.

CAUTIONS

Before connecting the power sensor to another instrument, ensure that the instrument and power meter are connected to the protective (earth) ground.

Exceeding the energy and power levels shown below may result in damage to the power meter system.

Do not apply torque to the sensor or the attenuator cooling cage while connecting or disconnecting the Type N RF connector.

The maximum RF signal level that may be coupled to the power sensor is listed below. Damage will result when the sensor is subjected to power or energy levels outside the limits listed.

Maximum average power:
30W at 0 to ≤+35°C
25W at >+35°C up to +55°C

Maximum peak power:
500W for the 8481B 10 MHz to ≤5.8 GHz
125W for the 8481B >5.8 GHz up to 18.0 GHz
500W for the 8482B 100 kHz to 4.2 GHz

Maximum energy per pulse:
500 W·μs

Calibration is Performed as Follows:

1. Disconnect sensor from the attenuator.

2. Set CAL FACTOR on meter to the cal factor number listed on sensor label.

3. Press the meter auto ZERO button.

4. Connect sensor to the power meter POWER REF.

5. For the HP 435A Power Meter, set the RANGE switch to 1W, and adjust the CAL ADJ control to bring the needle on the meter to the CAL position.

6. For the HP 436A Power Meter, adjust the CAL ADJ control to obtain a reading of 1W on the digital display.

7. Disconnect sensor from power meter and connect to the attenuator.

PERFORMANCE TEST AND ADJUSTMENT

SWR (Reflection Coefficient) Performance Test

The maximum SWR and reflection coefficient for the power sensor are listed in Table 1. When making these measurements, the SWR of the unit under test must be less than those listed in Table 1 plus the measurement uncertainty of the measuring system.

FET Balance Adjustments

The sampling gate balance is affected by the relative positions of the wires in the sensor which connect to pins G and H of connector J2. One wire is black and white, and the other is brown and white. Once positioned, care must be used not to displace these wires.

To correctly position these wires, after replacement of A2A2U1, connect an oscilloscope as follows to display switching transients:

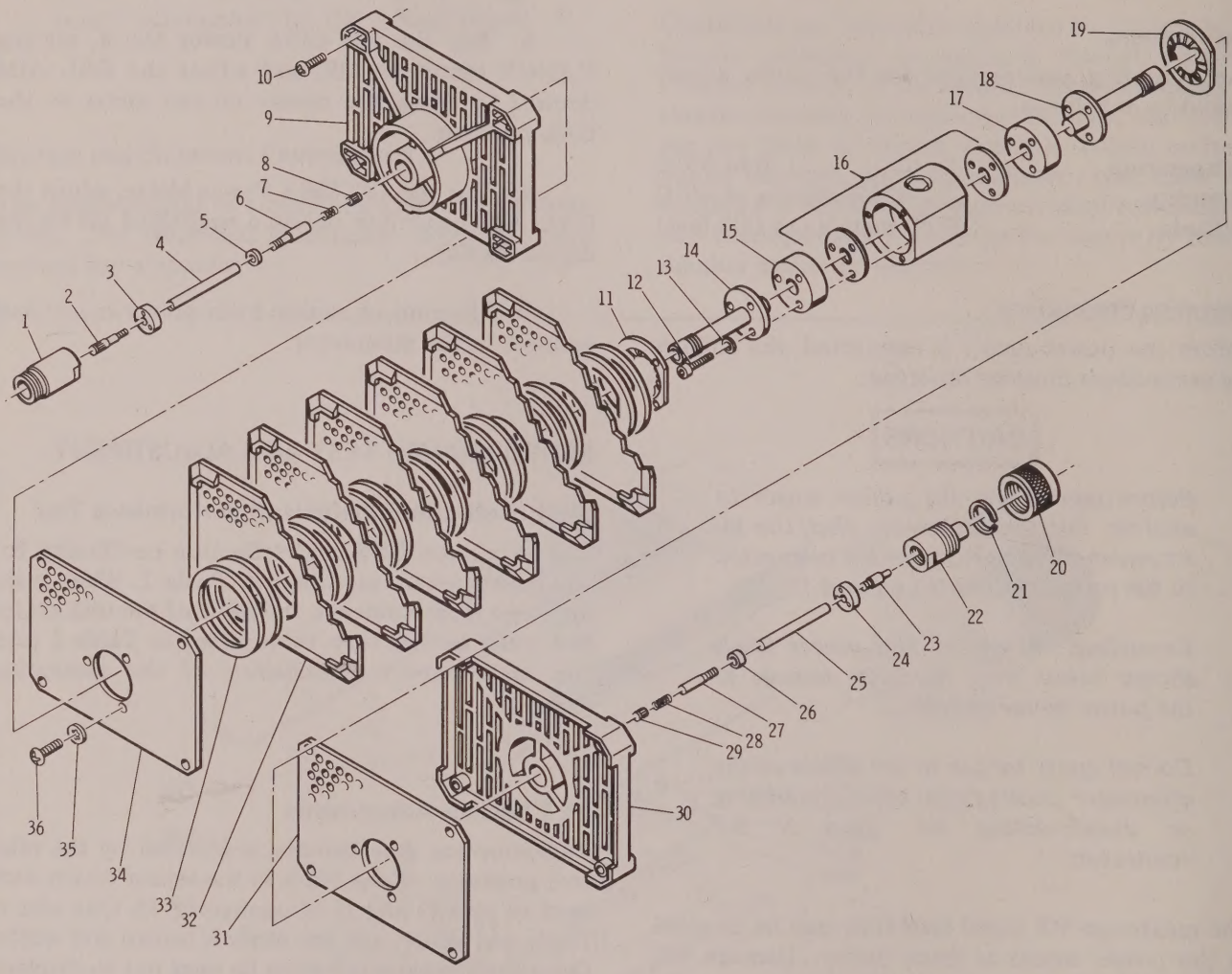
1. Test point A4TP4 in the HP 435A Power Meter, or

2. Test point A2TPAC (3) in the HP 436A Power Meter.

Adjust the black-and-white and brown-and-white wires until the switching transient amplitude is less than 0.8 Vp-p.

REPLACEABLE PARTS

Table 6 is a list of replaceable parts. Figure 1 illustrates the major parts of the sensor and Figure 2 shows the parts breakdown for the attenuator portion of the power sensor. To order a part, quote the Hewlett-Packard part number, the part number check digit (CD), specify the quantity required, and address the order to the nearest Hewlett-Packard office. To order a part not listed in Table 6, give the sensor model number, serial number, the description and function of the part, and the quantity of parts required.



NOTE – All Numbered callouts have a prefix A1MP when referring to the Replaceable Parts List.

Figure 2. Illustrated Parts Breakdown of the A1 Attenuator Assembly

Table 5. Parts Associated with Item 16 in Figure 2

Part	Qty	HP Part Number	Part	Qty	HP Part Number
30 dB, 25W Attenuator Card	1	1GT-2674	Washer	2	08498-20017
Attenuator Body	1	08498-20011	Lock Screw	2	08498-20022
Card Clamp Half Section	2	08498-20012	Tuning Screw	2	08498-20023

Table 6. Replaceable Parts (1 of 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	08498-60001	9	1	30DB, 25W ATTENUATOR	28480	08498-60001
A1MP1	08498-80001	1	1	OUTER CONNECTOR BODY TYPE N, FEMALE	28480	08498-80001
A1MP2	1250-0915	8	1	CONTACT-RF CONN SER APC-N FEMALE	02660	131-149
A1MP3	5040-0306	0	2	INSULATOR	28480	5040-0306
A1MP4	08498-20014	0	2	CENTER CONDUCTOR	28480	08498-20014
A1MP5	08498-20019	5	2	DAMPER	28480	08498-20019
A1MP6	08498-20016	2	2	CONTACT HOLDER	28480	08498-20016
A1MP7	1460-1618	5	2	SPRING-COMPRESSION	28480	1460-1618
A1MP8	5020-3297	2	2	CONTACT-SLIDING	28480	5020-3297
A1MP9	08498-40002	8	2	ATTENUATOR HOUSING	28480	08498-40002
A1MP10	2200-0145	2	8	SCREW-MACH 4-40 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A1MP11	08498-20024	2	2	RFI SEAL	28480	08498-20024
A1MP12	3030-0070	2	6	SCREW-SKT HD CAP 4-40 .625-IN-LG ALY STL	00000	ORDER BY DESCRIPTION
A1MP13	2190-0030	1	6	WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0030
A1MP14	08498-20013	9	2	INNER CONNECTOR BODY	28480	08498-20013
A1MP15	08498-20018	4	2	INSULATOR	28480	08498-20018
A1MP16	08498-60002	0	1	ATTENUATOR CARTRIDGE ASSEMBLY	28480	08498-60002
	08498-60003	1		RESTORED (08498-60002) ATTEN. CART. ASSY	28480	08498-60003
A1MP17	08498-20018	4		INSULATOR	28480	08498-20018
A1MP18	08498-20013	9		INNER CONNECTOR BODY	28480	08498-20013
A1MP19	08498-20024	2		RFI SEAL	28480	08498-20024
A1MP20	1250-0918	1	1	NUT-RF CONN SERIES APC-N SST	02660	131-135-1
A1MP21	1250-0016	0	1	RING-RF CONNECTOR SERIES N; .75IN OD	02660	82-1138-6
A1MP22	1250-0916	9	1	CONNECTOR-RF APC-N M UNMTD 50-OHM	28480	1250-0916
A1MP23	1250-0917	0	1	CONTACT-RF CONN SER APC-N MALE	02660	131-147
A1MP24	5040-0306	0		INSULATOR	28480	5040-0306
A1MP25	08498-20014	0		CENTER CONDUCTOR	28480	08498-20014
A1MP26	08498-20019	5		DAMPER	28480	08498-20019
A1MP27	08498-20016	2		CONTACT HOLDER	28480	08498-20016
A1MP28	1460-1618	5		SPRING-COMPRESSION	28480	1460-1618
A1MP29	5020-3297	2		CONTACT-SLIDING	28480	5020-3297
A1MP30	08498-40002	8		ATTENUATOR HOUSING	28480	08498-40002
A1MP31	08498-00002	4	2	END FIN	28480	08498-00002
A1MP32	08498-40001	7	6	FRAMED ATTENUATOR FIN	28480	08498-40001
A1MP33	08498-00004	6	14	"D" RING SPACER	28480	08498-00004
A1MP34	08498-00002	4		END FIN	28480	08498-00002
A1MP35	2190-0014	1	6	WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
A1MP36	0520-0129	8	6	SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A2	8481B	0	1	SENSOR ASSEMBLY- 10MHZ TO 18GHZ	28480	8481B
A2	8482B	2	1	SENSOR ASSEMBLY- 100MHZ TO 4.2GHZ	28480	8482B
A2C1	0160-0565	2	7	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-0565
A2C2	0160-0565	2		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-0565
A2C3	0160-0565	2		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-0565
A2C4	0160-0565	2		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-0565
A2C5	0160-0565	2		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-0565
A2C6	0160-0565	2		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-0565
A2C7	0160-0565	2		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-0565
A2J1	08481-60026	9	1	CONNECTOR ASSEMBLY	28480	08481-60026
A2MP1	08481-40002	9	2	SHELL-PLASTIC	28480	08481-40002
A2MP2	08481-40002	9		SHELL-PLASTIC	28480	08481-40002
A2MP3	08481-20011	8	2	CHASSIS	28480	08481-20011
A2MP4	08481-20011	8		CHASSIS	28480	08481-20011
A2MP5	08481-20008	3	1	END BELL	28480	08481-20008
A2MP6	1460-1224	9	1	SPRING-CPRSN .088-IN-OD .188-IN-OA-LG	28480	1460-1224
A2MP7	1251-3363	8	1	NUT,CONN,RND SPANNER NUT,AUDIO TYPE CONN	28480	1251-3363
A2MP8	08481-00002	5	2	SHIELD	28480	08481-00002
A2MP9	08481-00002	5		SHIELD	28480	08481-00002
A2MP22	3030-0422	8	13	SCREW-SKT HD CAP 0-80 .188-IN-LG SST-302	00000	ORDER BY DESCRIPTION
A2MP23	3030-0436	4	1	SCREW-SKT HD CAP 0-80 .5-IN-LG SST-300	00000	ORDER BY DESCRIPTION
A2MP24	5040-6939	7	1	CLAMP	28480	5040-6939
A2MP25	5040-6940	0	1	BLOCK	28480	5040-6940
A2MP26	7120-7129	7	1	LABEL-ID (FOR 8481B ONLY)	28480	7120-7129
	7120-7130	0	1	LABEL-ID (FOR 8482B ONLY)	28480	7120-7130
A2R1	0698-7255	0	1	RESISTOR 6.19K 1% .05W F TC=0+-100	24546	C3-1/8-T0-6191-G
A2A1	08481-60019	0	1	BULKHEAD ASSEMBLY-TYPE N(FOR 8481B ONLY)	28480	08481-60019
A2A1	08482-60011	3	1	BULKHEAD ASSEMBLY-TYPE N(FOR 8482B ONLY)	28480	08482-60011

See introduction to this section for ordering information
*Indicates factory selected value

Table 6. Replaceable Parts (2 of 2)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2A2	08481-60025	8	1	INPUT AMPLIFIER BD.ASSY.(FOR 8481B ONLY)	28480	08481-60025
A2A2	08482-60013	5	1	INPUT AMPLIFIER BD.ASSY.(FOR 8482B ONLY)	28480	08482-60013
A2A2C1	0180-2515	8	2	CAPACITOR-FXD 47UF+-20% 6VDC TA (FOR 8481B ONLY)	28480	0180-2515
A2A2C1	0180-0555	2	1	CAPACITOR-FXD 39UF+-20% 10VDC TA (FOR 8482B ONLY)	28480	0180-0555
A2A2C2	0160-4306	7	4	CAPACITOR-FXD 100PF +-10% 100VDC CER	51959	0805C101K3P
A2A2C3	0160-4306	7		CAPACITOR-FXD 100PF +-10% 100VDC CER	51959	0805C101K3P
A2A2C4	0180-0594	9	1	CAPACITOR-FXD 3.3UF+-20% 15VDC TA	28480	0180-0594
A2A2C5	0160-3094	8	1	CAPACITOR-FXD .1UF +-10% 100VDC CER	28480	0160-3094
A2A2C6	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A2A2C7	0160-4306	7		CAPACITOR-FXD 100PF +-10% 100VDC CER	51959	0805C101K3P
A2A2C8	0160-4306	7		CAPACITOR-FXD 100PF +-10% 100VDC CER	51959	0805C101K3P
A2A2C9	0180-2515	8		CAPACITOR-FXD 47UF+-20% 6VDC TA	28480	0180-2515
A2A2C10	0180-2545	4	1	CAPACITOR-FXD 100UF+-20% 4VDC TA	28480	0180-2545
A2A2Q1	1854-0610	0	1	TRANSISTOR NPN SI TO-46 FT=800MHZ	28480	1854-0610
A2A2R1	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+-100 (FOR 8481B ONLY)	28480	0698-3260
A2A2R1	0757-0483	8	1	RESISTOR 562K 1% .125W F TC=0+-100 (FOR 8482B ONLY)	28480	0757-0483
A2A2R2	0698-7248	1	1	RESISTOR 3.16K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3161-G
A2A2R3	0698-7224	3	1	RESISTOR 316 1% .05W F TC=0+-100	24546	C3-1/8-T0-316R-G
A2A2R4	0698-7236	7	1	RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-G
A2A2RT1	0811-3210	1	1	RESISTOR 31.6 5% .05W PWW TC=+5040+-250	14140	1409-1/20-31R6-J
A2A2U1	1813-0060	8	1	IC TO-8 PKG	28480	1813-0060
				A2 MISCELLANEOUS PARTS		
	0350-0153	7	1	SCALE-RANGE SWITCH (FOR 435-SERIES POWER METERS)	28480	0350-0153
	0590-1040	1	1	THREADED INSERT-NUT 0-80 .06-IN-LG SST	28480	0590-1040
	5040-6938	6	1	SPACER	28480	5040-6938
	7120-7127	9	1	LABEL-IDENTIFICATION	28480	7120-7127

Table 7. Manufacturers Code List

Mfr Code	Manufacturer Name	Address		Zip Code
00000	ANY SATISFACTORY SUPPLIER			
02660	AMPHENOL SALES DIV OF BUNKER-RAMO	BROADVIEW	IL	60153
14140	EDISON ELEK DIV MCGRAW-EDISON	MANCHESTER	NH	03130
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD	PA	16701
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO	CA	94304
51959	VICLAN INC	SAN DIEGO	CA	92138

See introduction to this section for ordering information
*Indicates factory selected value

SERVICE

Test equipment which meets or exceeds the critical specifications in Table 4 may be used in place of the recommended instruments for troubleshooting the power sensor.

Figure 3 shows the locations of the components and assemblies of the sensor. Figure 4 is the schematic diagram of the power sensor.

Principles of Operation

The sensor assembly and the 30 dB, 25W attenuator assembly present a 50-ohm load to the RF source. The RF signal absorbed by the thermocouples in the sensor generates a dc voltage that is proportional to the RF input power.

Components A2E1 and A2E2 are ferrite beads situated in the black plastic block through which the wires from A2A1 pass to A2A2. Each ferrite bead increases the self-inductance of the wire passing through the bead, causing this portion of wire to act as an RF choke. The result is to minimize RF feedthrough to the A2A2 input amplifier assembly.

The dc output from the bulkhead assembly is applied to the two field-effect transistors (FET's) in A2A1U1. These transistors function as a sampling gate (or chopper). The sampling rate is controlled by a 220 Hz square wave supplied by the power meter. The sampling gate output (at pin 3 of A2A2U1) is a 220 Hz square wave having a voltage proportional to the RF power input.

The output of A2A2U1 is amplified about 700 times by an operational amplifier made up of A2A2 and the first amplifier stage in the power meter. Figure 5 is a simplified diagram of the power measuring system.

The Auto Zero Feedback circuit is coupled to the power sensor from the power meter. The dc voltage used to set the zero level is applied to the input of FET A2A2U1 by using A2A2R1 and the series resistance of the thermocouple A2A1TC1 as a voltage divider.

When the power sensor is used with the HP 436A Power Meter, A2R1 mount resistor is in the circuit. As a result, the power meter automatically selects the proper measurement range. The 6190 ohm resistance of A2R1 causes selection of the 0 to +44 dBm range. With the HP 435A Power Meter, A2R1 serves no function.

Troubleshooting

The troubleshooting information which follows is intended to isolate a problem to a stage. The defective component can then be identified by voltage and resistance checks. The field-effect transistors (FET's) in A2A2U1 are slightly light sensitive. As a result, dc levels are shifted slightly when the FET's are exposed.

CAUTION

Be extremely careful when measuring across the gold wires. They are delicate and can be damaged easily.

Resistance measured across the two gold wires leading to the A2A2 assembly should be 200 ±10 ohms (8481B) or 245 ±12.5 ohms (8482B). Note that excessive power will damage either the attenuator or the thermocouples. If the 30 dB pad is damaged it could present an open circuit to the input signal. If the thermocouples are damaged their resistance will increase. If the A2A1 Bulkhead Assembly is defective, the entire Bulkhead Assembly must be replaced.

The FET's in A2A2U1 may be checked by the following procedure:

1. Disconnect the cables from the power sensor.

2. Remove the upper chassis from the sensor. (refer to disassembly procedures).

3. Measure the resistance between pins 1 and 2 of the A2A2U1. The resistance should be 15 ±0.75 ohms. The same resistance should be found between pins 8 and 9 of A2A2U1.

4. Short pins 4, 6, and 9 of A2A2U1. While the pins are shorted, measure the resistance between pins 2 and 3, and between pins 3 and 8, of A2A2U1. The resistance should be less than 40 ohms.

5. Set a power supply to 10 Vdc.

6. Connect the positive side of the power source to the power sensor signal ground. Connect the negative power supply lead to pins 4 and 6 of A2A2U1.

7. Measure the resistance between pins 2 and 3 of A2A2U1. Also measure the resistance between

Figure 3. Component and Assembly Locations of the Sensor

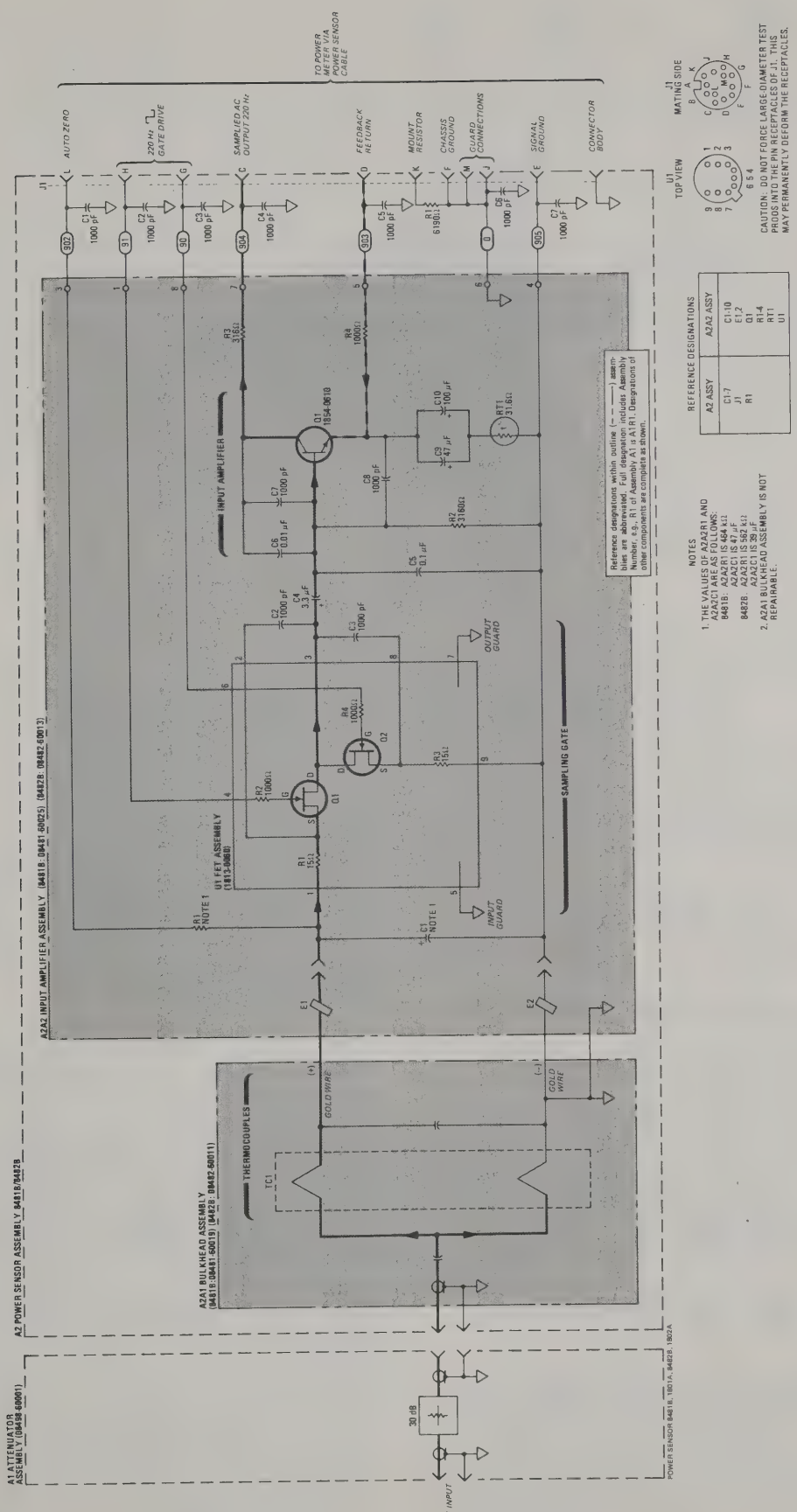


Figure 4. Schematic Diagram of the Power Sensor

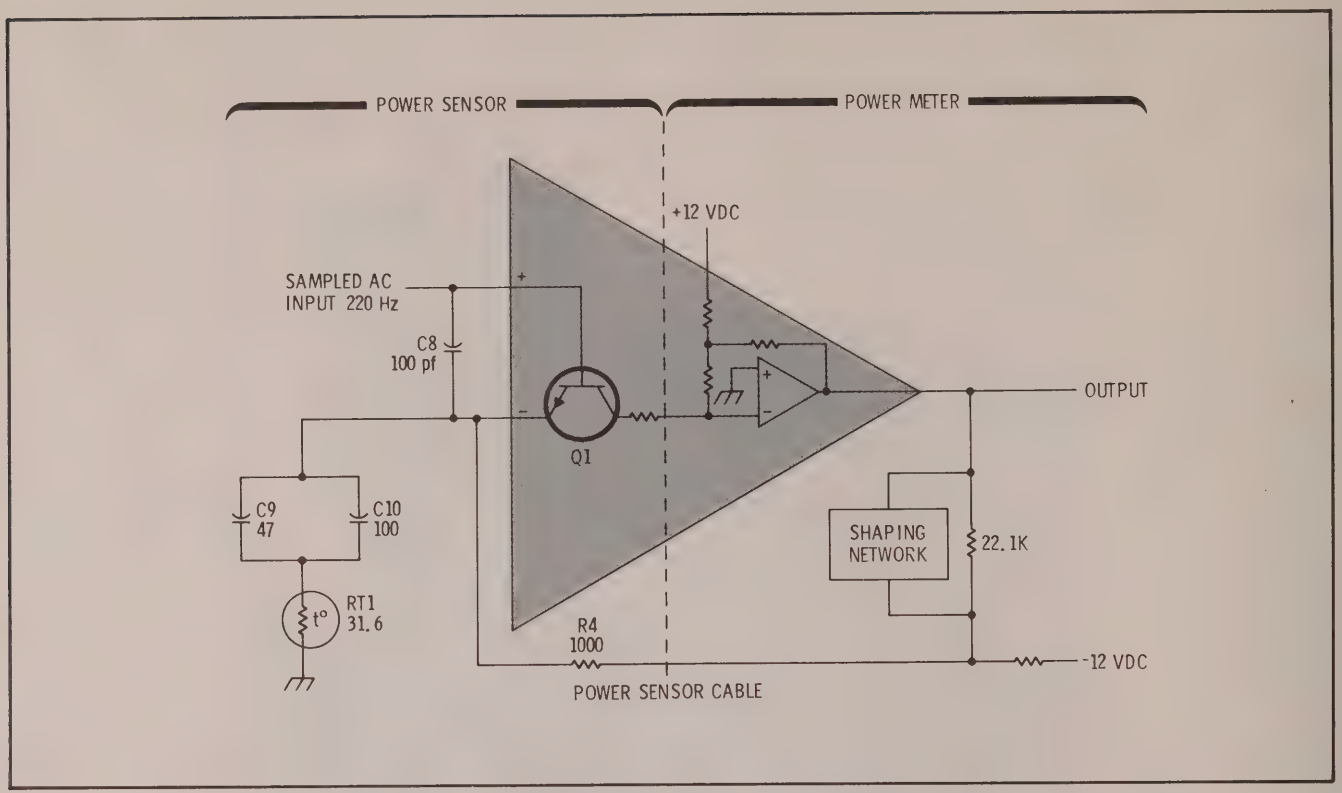


Figure 5. Simplified Diagram of the Power Measuring System

pins 3 and 8 of A2U1. In both cases, the resistance should be several hundred times the resistance found in step d.

The 220 Hz drive from the power meter should have the following levels:

1. —0.05 ±0.05 Vdc (top of square wave).

2. > —9 Vdc (bottom of square wave).

In most cases it may be assumed that the operational amplifier (made up of A2A2Q1 and the first amplifier in the power meter) is operating correctly if the dc voltage on the metal cover of A2A2Q1 (collector) is —70 ±30 mVdc.

REPAIR

Cleanliness

Do not handle the A2A2 input amplifier circuit board more than necessary. Dirt or moisture from the hands may make the circuits inoperative. Do not use solder-flux remover on the circuit board. It is particularly important to keep the area around A2A2U1 clean.

Soldering Techniques

The sensor is a very sensitive device, and is affected by very small differences in temperature between its components. Therefore, after the performance of any soldering in the unit, several hours must be allowed for the unit to reach thermal equilibrium before it is used or tested.

Capacitors A2A2C2, A2A2C3, A2A2C7, and A2A2C8 require low-temperature soldering techniques. The connections to these capacitors are a gold film deposited on a ceramic base. Molten solder results in the gold forming an amalgam with the solder, and the consequent removal of the gold from its ceramic base. Soldering must be done quickly, and a low-temperature soldering iron and solder must be used. The capacitors must be discarded if unsoldered. If integrated circuit A2A2U1 or transistor A2A2Q1 is replaced, two of these capacitors must be removed, and therefore must be replaced with new ones. The required low-temperature soldering iron and solder are as follows:

1. Hexacon Thermo-O-Trac soldering iron with J206X tip, temperature 600°F (311°C).

2. Low-temperature solder SN 62, HP Part Number 5090-0410.

Sensor Disassembly Procedures

CAUTIONS

Disassembly must be performed in the sequence described below, otherwise damage may be caused to the two gold wires between the A2A1 bulkhead assembly and the A2A2 input amplifier assembly. If these wires are damaged, the A2A1 bulkhead assembly must be returned to the factory for repair.

Each sensor has an individually prepared graph on the housing. If more than one sensor is disassembled, be sure to use the proper housing for each when they are reassembled.

Disassemble the sensor by performing the following steps:

CAUTION

The gold wires connecting the A2A1 Bulkhead Assembly and the A2A2 Input Amplifier Assembly are extremely delicate and may be easily broken. Be careful when working around them.

1. Remove the sensor from the high power attenuator. Insert the blade of a small screwdriver between the two-piece plastic shell at the rear of the sensor. Gently pry the sections apart. (See Figure 6.)

2. Proceed to the other side of the connector and again pry the cover sections apart. Remove the shells and magnetic shields.

3. Position the sensor as shown in Figure 7. The small hole ❺ should be on the left side of the RF input connector. Remove the allen cap screws ❶ , ❷ , ❿ , and ⓭ . Loosen ⓫ and ⓬ . Remove the upper chassis from the sensor.

4. Remove the spring clamp cap screw ❼ to free the gold leads which come from the bulkhead assembly.

5. Remove cap screws ❸ , ❹ , and ❻ .

6. Slide the bulkhead assembly straight out from the chassis.

7. Remove cap screws ❽ , ❾ , ⓫ , ⓬ , ⓮ , and ⓯ .

8. Lift the A2A2 Input Amplifier and A2J1 connector out of the chassis.

Sensor Reassembly Procedures

CAUTION

The gold wires connecting the A2A1 Bulkhead Assembly and the A2A2 Input Amplifier Assembly are extremely delicate and may be easily broken. Be careful when working around them.

1. Place the printed circuit board and connector into place.

2. Cap screws ❽ , ❾ , ⓫ , ⓬ , ⓮ , and ⓯ must be inserted but not tightened. Refer to Figure 7.

3. Center the circuit board so there is equal air gap between each side and the chassis. Tighten ❽ , ❾ , ⓮ , and ⓯ .

4. With small hole ❺ to the left, carefully insert the gold leads on A2A1 Bulkhead Assembly through the holes in the black plastic guide on A2A2 Input Assembly.

5. Insert screws ❸ , ❹ , and ❻ . Tighten only screw ❻ .

6. Position the ends of the gold wires over the pads on A2A2U1. The wires should not pass over the hole in the pad. Lightly clamp the leads in place with screw ❼ . DO NOT fully compress the spring.

7. Place the upper chassis in position and insert cap screws ❶ , ❷ , ❿ , and ⓭ .

8. Tighten ❶ , ❷ , ❸ , and ❹ .

9. Tighten ❿ , ⓫ , ⓬ , and ⓭ .

10. Place the plastic shells, magnetic shields, and the chassis together as shown in Figure 1. Snap the plastic shells together.

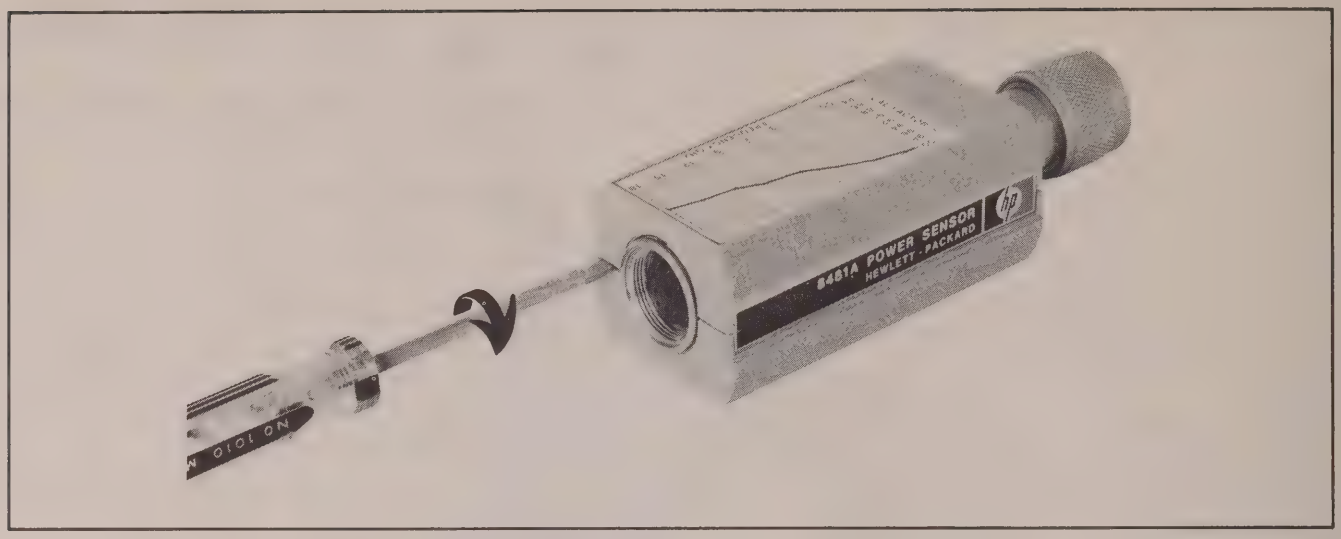


Figure 6. Removing the Sensor Cover

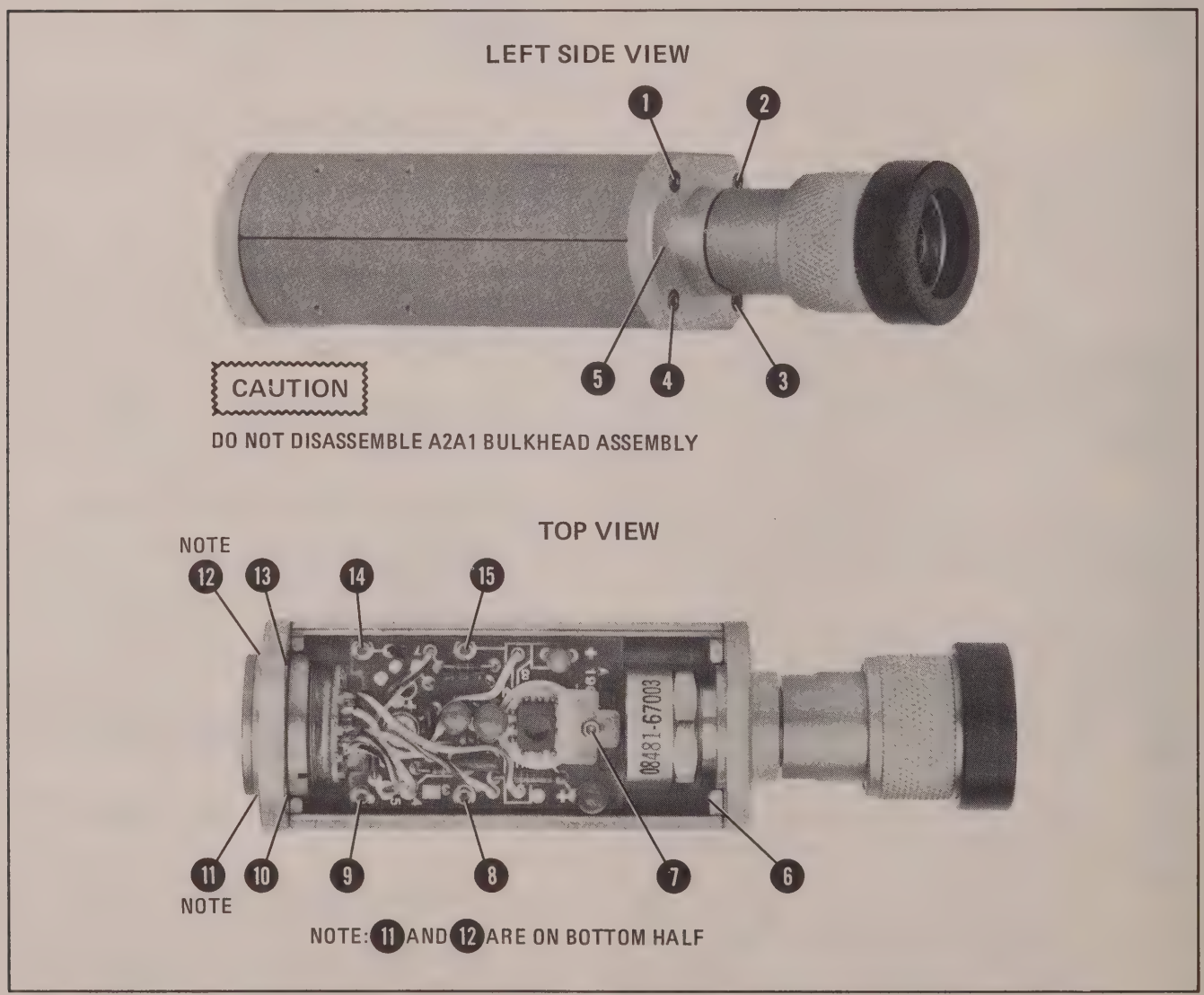


Figure 7. Sensor Hardware Locations

Attenuator Disassembly Procedure

NOTE

To replace the attenuator cartridge assembly follow this procedure, and see Figure 2 for numbered callouts.

1. Remove the 8 screws (10) that hold the two attenuator housings (9) and (30).

2. The two housings will remain attached to the overall assembly unless the connector assemblies (1) and (22) have been removed.

3. Remove the three screws (36) and lockwashers (35) from both ends of the attenuator cartridge assembly (16).

4. Remove the end fins (31) and (34), the RFI seals (11) and (19), spacers (33) and the framed attenuator fins (32). There are two "D" ring spacers between each of the framed attenuator fins and the end fins.

5. Remove the three cap screws (12) and the lock washers (13) from both ends. It may be necessary to move the housing slightly to remove the screws.

6. Slide the inner connector bodies (14) and (18) from the attenuator cartridge assembly (16). Be careful not to let the sliding contacts (8) and (29), and compression springs (7) and (28) to slide from the contact holders (6) and (27). Under normal conditions they will not slide out.

7. At this point the attenuator cartridge assembly (16) and the shim washers are free from the overall assembly and can be returned to Hewlett-Packard. The attenuator cartridge assembly is the housing for the attenuator card, the card half sections, and the shims.

Attenuator Reassembly Procedure

1. Place the framed attenuator fins (32), "D" ring spacers (33) and end fins (31) and (34) on the attenuator cartridge assembly (16).

2. Position RFI seals (11) and (19) and install end fins (31) and (34) with screws (36) and lock washers (35).

3. Install the connector assemblies with the six screws (12) and lock washers (13). Tighten screws evenly to a torque specification of 0.45 N·m (4 inch-pounds).

CAUTION

Overtightening screws (12) beyond the specified torque may distort the Card Clamp Half Sections and fracture the Attenuator Card.

4. Install the eight screws (10) that hold the two housings (9) and (30).

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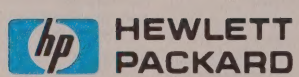

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